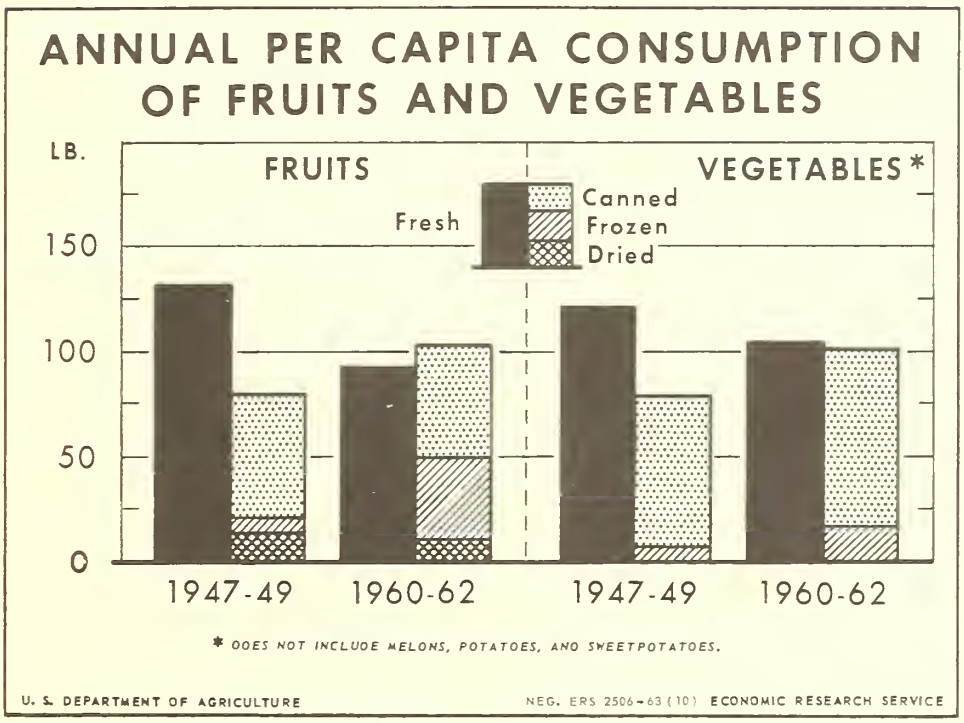
Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

A281.7
Ag83E
Cop. 2

TRENDS IN MARKETING FRUITS AND VEGETABLES



MARKETING ECONOMICS DIVISION
ECONOMIC RESEARCH SERVICE
U.S. DEPARTMENT OF AGRICULTURE

Article Reprinted From
The Marketing and Transportation Situation
November 1963

ERS-148

TRENDS IN MARKETING FRUITS AND VEGETABLES 1/

Producers, distributors, and processors of fruits and vegetables have adjusted to many production and marketing changes in the last 20 years. These changes include greater specialization in production, improved farming practices, higher volume of the products processed, slow growth in the volume marketed fresh, the rise of supermarkets, increased buying at shipping points by retailers, and the development of new processed products.

Reasons for change in the fruit and vegetable industry include such broad social and economic forces as population growth, rising levels of living, increased urbanization, and changes in consumers' tastes. Specific factors accounting for changes included such developments as new and improved varieties of crops, improved technology in production and processing, more rapid and efficient communication facilities, and faster and more dependable transportation.

This article attempts to summarize some of the changes of the last 2 decades and discusses some likely future changes.

Production and Utilization

Fruit.--The volume of fruit marketed for fresh consumption has declined since World War II. Grower sales of the principal fruits to fresh fruit marketing firms and consumers averaged 6.6 million tons in 1960-62, a 14 percent smaller volume than in 1947-49. 2/ Sales of fresh noncitrus fruits dropped only slightly, but fresh citrus fruit sales were down 26 percent in 1960-62 from the earlier period.

Growers' annual sales of fruits to processors averaged about 10.4 million tons in 1960-62, about a third more than in 1947-49. The volume of citrus fruits sold to processors was 56 percent larger than in 1947-49, and sales of noncitrus fruits were up 18 percent. By 1960-62, the volume of both kinds of fruits processed exceeded that marketed for fresh use.

Fruit production is concentrated in areas having a comparative advantage due largely to climate, and to a lesser extent to production facilities and market outlets. Fruit production though retarded at times because of adverse weather, is relatively stable because it involves long-range investment. Once established, groves, orchards, and vineyards are not readily abandoned in response to higher production costs or lower fruit prices.

Deciduous fruit production is widely dispersed, geographically, but the Pacific Coast States accounted for about three-fifths of the production in 1960-62. Other concentrated-producing areas are in Michigan, New York, and the Appalachian area. Citrus fruit production increased in Florida between the 1947-49 and 1960-62 periods, and declined in California. Florida produced about three-fourths of the citrus fruit in 1960-62. California, Arizona, and Texas accounted for most of the remainder.

Vegetables.--The annual commercial production of vegetables and melons to be marketed mainly in fresh form averaged 12.5 million tons in 1960-62, compared with 11.0 million tons in 1947-49. Production to be marketed in processed form averaged 8.3 million tons in 1960-62, up from 5.5 million tons in 1947-49.

California, the leading State in the production of fresh market vegetables and melons, accounted for about 32 percent of total U. S. production in 1960-62. Florida, the second leading State, produced about 14 percent of the total. Texas ranked third with 10 percent, and Arizona fourth with 7

1/ Prepared by Jules V. Powell, agricultural economist, Marketing Economics Division, Economic Research Service, USDA.

2/ Data in this section were compiled from reports of the Statistical Reporting Service, USDA.

percent. Each of these States increased its share of the U. S. total from 1947-49 to 1960-62. The Western States produced 45 percent of the total for fresh use in 1960-62, compared with 42 percent in 1947-49. Production increases in California, Florida, Texas, and Arizona have also raised U. S. output of winter and spring vegetables relative to summer and fall vegetables. Consumers have benefited from the reduction in fluctuation of supplies and the extended marketing season for most fresh vegetables.

The Western States lead other U. S. regions in production of vegetables for processing. Such production in these States more than doubled from 1947-49 to 1960-62. They produced 45 percent of the total U. S. volume in 1960-62 compared with 32 percent in 1947-49. Production in the North Central region, second in rank, increased about a third from 1947-49 to 1960-62. In the latter period, these States produced 32 percent of the U. S. total compared with 37 percent in 1947-49.

Potatoes and sweetpotatoes.--Potato production averaged 272.6 million hundredweight a year in 1960-62, up 13 percent from the 1947-49 average. Production of sweetpotatoes averaged about 16.6 million hundredweight in 1960-62, down 34 percent from 1947-49.

Increased specialization.--According to Census enumerations, farms harvesting vegetables for sale numbered 184,162 in 1959, down from 347,850 in 1949. 3/ The number of farms producing fruits also decreased. These decreases indicate that specialization in production has increased.

Much of the production of fruits and vegetables, particularly in the concentrated-producing areas, is on farms that are large, specialized, highly mechanized, and efficient. Not many years ago, most fruits and vegetables were produced mainly for the fresh market, and the excess production was sent to processors.

Specialization, mechanization, improved cultural practices, and better plants have greatly increased efficiency. The index of man-hours of labor used in vegetable production declined from 147 in 1947-49 (1957-59 = 100) to 93 in 1960-62. During the same period, the index of farm production of vegetables rose from 94 to 107. 4/ For fruit and nut crops, man-hours used in production decreased from 118 in 1947-49 to 101 in 1960-62, while the index of farm production rose from 97 to 105.

Concurrent with the development of new technologies of production and harvesting, is the development of new varieties of fruits and vegetables that are more adaptable to these new techniques, give higher yields, have more flavor, and retain quality better in marketing channels. Several tomato varieties, introduced in California and Ohio, are more adaptable to mechanical harvesting than varieties previously grown.

Tomato production in southern New Jersey furnishes an example of the increased yields. New Jersey's tomato acreage has decreased but production has increased. Growers, especially those producing for processors, have increased their yields per acre. Only a few years ago, a 10-ton per acre yield was a mark of distinction. Today, some New Jersey growers average 15 tons per acre, and in 1961 the champion grower produced 33 tons. 5/ For potatoes, the national average yield rose from 80 hundredweight per acre in 1940 to 194 hundredweight in 1962.

Consumption

The annual per capita consumption of

3/ A change in the Census definition of a farm accounted for a small part of the decrease in the number of farms.

4/ Changes in Farm Production and Efficiency, A Summary Report, 1963, Stat. Bull. 233, (Revised July 1963) U. S. Dept. Agr., Farm Prod. Econ. Div., Econ. Res. Serv.

5/ Business Review, Federal Reserve Bank of Philadelphia, September 1962.

fruit in all forms decreased from 212 pounds (fresh equivalent) in 1947-49 to 196 pounds in 1962. However, per capita consumption has varied closely around the 200 pound level since 1950. Between 1947-49 and 1962, consumption of vegetables (excluding potatoes, sweetpotatoes and melons) increased from about 200 to 207 pounds per capita (tables 9 and 10). Shifts in the proportions consumed fresh, canned, frozen and dried occurred for both fruits and vegetables. While the per capita consumption of fresh products declined, per capita consumption of canned and frozen fruits and vegetables increased.

The phenomenal increase in the consumption of frozen concentrated citrus juices is the most striking change in fruit consumption. These products, introduced in the late 1940's, were consumed at a rate of 37 pounds (fresh weight equivalent basis) per person in 1962--45 percent of the total per capita consumption of citrus fruits. Canned citrus juices accounted for an additional 17 percent. Per capita consumption of fresh citrus fruits declined 47 percent from 1947-49 to 1962. Total consumption of citrus fruits in all forms declined 7 percent.

From 1947-49 to 1962, per capita apple consumption declined 11 percent. In 1962, 72 percent was consumed fresh, compared with 84 percent in 1947-49. Per capita consumption of canned apples (mostly apple sauce) and juice increased sharply, but these items accounted for only 24 percent of all apples consumed in 1962. Frozen and dried apples are minor items, and consumption of both declined from 1947-49 levels.

Per capita consumption of other noncitrus fruits also declined. These items display much the same consumption pattern as apples except that the frozen products show increases. Fresh fruits accounted for nearly 50 percent of per capita consumption of these noncitrus fruits in 1962, down from 56 percent in 1947-49. Canned and frozen fruit and canned juices accounted for 40 percent of the consumption of noncitrus fruit except apples in 1962, compared with 29 percent in 1947-49.

Similar, though less dramatic, are shifts in vegetable consumption. In 1962, consumption of all vegetables and melons totaled 347 pounds (fresh equivalent) per person, 2 percent less than in 1947-49. This 1962 total comprised 117 pounds of potatoes and sweetpotatoes, 23 pounds of melons, 60 pounds of tomatoes, and 147 pounds of all other vegetables. Of these 4 broad groups, only per capita consumption of tomatoes increased. This rate for tomatoes increased by 23 percent from 1947-49, but all of it showed up in the form of canned tomatoes and tomato products. Consumption of fresh tomatoes decreased 9 percent from 1947-49.

Per capita consumption of all other fresh vegetables (as a group) declined, and was only partially offset by increased consumption of canned and frozen vegetables. Frozen leafy, green, and yellow vegetables increased 163 percent from 1947-49 to 1962, and frozen "other" vegetable use increased 193 percent during the same period. However, the frozen form accounted for only 17 percent of the per capita consumption of the leafy, green, and yellow vegetables and 6 percent of the "other" vegetables.

Dramatic shifts have occurred in the consumption of potatoes and sweetpotatoes. While the per capita consumption of fresh potatoes decreased from 113 pounds in 1947-49 to 99 pounds in 1962, 6/ frozen potato use increased from 0.1 pound in 1947-49 to 9.3 pounds per person in 1962. Consumption of dehydrated potatoes rose from 0.2 pound in 1950 to 5.2 pounds per person in 1962. However, frozen potatoes account for only 8 percent of the total per capita consumption, and dehydrated potatoes for 5 percent.

Consumption of fresh sweetpotatoes declined greatly from 1947-49 to 1962.

6/ These averages include small quantities of potatoes processed into potato chips and shoe-string potatoes.

Canned (including small quantities of dehydrated) sweetpotatoes increased 200 percent during the same period, but the per capita consumption of 1.5 pounds in 1962 comprised only 19 percent of the total.

Per capita consumption of all fruits and vegetables combined has declined because of less consumption of fresh produce and only partially offsetting increases in the processed products. In 1962, fresh fruits and vegetables, (excluding potatoes, sweetpotatoes, and melons) accounted for half the total per capita consumption of these items. The large volume increase of canned and frozen fruits and vegetables between 1947-49 and 1962 indicates that in the years ahead an increasing portion of total per capita consumption will consist of the processed forms.

Expected shifts between fresh and processed forms of certain fruits and vegetables took place, but the overall consumption level throughout the 1950's remained fairly constant. Changes in relative prices of various food products may partly explain why over-all growth did not occur. Retail prices of fresh fruits averaged 43 percent higher in 1962 than in 1947-49; retail prices of fresh vegetables were up 35 percent. Processed fruits and vegetables showed a smaller rise--17 percent. During the same period retail prices of all farm-originated foods increased only 14 percent.

Wholesaling Fresh Fruits and Vegetables

The growth of direct buying.--Retail food chains in the early 1920's began buying fresh fruits and vegetables directly from shipping-point dealers and growers rather than from city wholesalers. The national chains adopted the practice first, and some large regional and local chains joined in by the late twenties. By 1936, chains purchased directly at shipping points 10 to 15 percent of the produce volume entering the major wholesale markets. In 1958, direct purchases at shipping points by corporated and voluntary chains and retailer-owned cooperatives accounted for 26 percent of the total receipts in 52 large cities. 7/ Chains and other retail organizations in these 52 cities bought 50 percent of their total volume directly at shipping points and an additional 6 percent directly from nearby producers.

After World War II, the number of chains large enough to engage in direct buying increased rapidly. National and regional chains did about 90 percent of the direct buying in 1958. The percentage of total retail food store sales made by the national chains has changed little since the mid-1930's. However, the regional chains' share has increased sharply, as their number and size has grown. In 1935, 3 regional chains did about 3 percent of the total retail food store business. By 1948, 8 regional chains had 5 percent of the business; and by 1958, 20 did 12 percent of the business. Thus, most of the increase in direct buying was due to the increased number and sales of regional chains. Some large local chains that started direct buying accounted for the remaining portion of the increase. Some retailer cooperative and voluntary chains have added produce lines and are buying some items directly at shipping points.

Procurement methods and buying practices of different purchasing groups vary, but there are broad similarities within the major types. Each of the national retail food chains has an extensive field-buying staff, with offices (year-round or seasonal) in the major producing areas. These buyers, who are familiar with supplies in the area and the requirements of their firms, can buy from growers and shippers on the basis of actual inspection. The national chains buy about

7/ Manchester, Alden C., "The Changing Organization of Wholesale Markets," Produce Marketing, May 1962. The section on marketing fresh fruits and vegetables is based largely on research work conducted by the Marketing Economics Division, ERS.

Table 9.--Fruits: Per capita consumption, farm-weight equivalent, average 1947-49, and years 1960-62 1/

Product	1947-49	1960	1961	1962 2/	Percentage change 1962 from 1947-49
	Pounds	Pounds	Pounds	Pounds	Percent
Citrus fruits:					
Fresh 3/	54.8	33.3	30.4	29.1	-47
Canned 4/	1.8	2.7	2.5	2.6	44
Juice, canned 5/	30.8	15.3	13.7	14.4	-53
Juice, frozen concentrate	2.5	34.3	32.3	37.3	1,392
Total	89.9	85.6	78.9	83.4	-7
Apples:					
Fresh 6/	25.5	20.1	18.6	19.5	-24
Canned	2.7	4.9	5.1	4.9	81
Juice, canned	.4	1.4	1.5	1.6	300
Frozen	.6	.7	.6	.5	-17
Dried	1.2	.7	.7	.7	-42
Total	30.4	27.8	26.5	27.2	-11
Other fruits:					
Fresh	51.8	44.1	43.0	40.4	-22
Canned	18.4	21.1	21.4	21.4	16
Juice, canned	5.7	8.1	9.7	9.5	67
Frozen	2.5	3.0	3.1	3.4	36
Dried	13.5	10.5	10.2	10.2	-24
Total	91.9	86.8	87.4	84.9	-8
Total	212.2	200.2	192.8	195.5	-8

1/ Excludes quantities consumed as baby food. Unless otherwise noted, data are for a calendar year. Civilian consumption only.
2/ Preliminary.
3/ Seasons start October or November prior to year indicated.
4/ Pack year beginning November prior to year indicated. Data for 1960-62 include chilled segments.
5/ Includes chilled juices.
6/ Apples grown in commercial areas only.

The Fruit Situation, ERS, USDA, TFS-148, Aug. 1963. Farm-weight equivalent derived using constant conversion factors for individual fruits and vegetables, except juices, for which factors have been adjusted since 1948 to allow for increased yield.

Table 10.--Vegetables, melons, potatoes, and sweetpotatoes: Per capita consumption, farm weight equivalent, 1947-49 average, and by years 1960-62 1/

Product	1947-49	1960	1961	1962 2/	Percentage change 1962 from 1947-49
	Pounds	Pounds	Pounds	Pounds	Percent
Tomatoes:					
Fresh	13.8	12.6	12.7	12.5	-9
Canned 3/	34.6	45.6	46.8	47.1	36
Total	48.4	58.2	59.5	59.6	23
Vegetables, leafy, green, yellow: 4/					
Fresh	62.0	52.1	51.9	51.0	-18
Canned 3/	16.3	16.3	16.0	16.0	-2
Frozen	5.2	12.8	12.6	13.7	163
Total	83.5	81.2	80.5	80.7	-3
Vegetables, other:					
Fresh	44.8	41.3	40.5	39.4	-12
Canned 3/	21.6	22.0	21.4	22.9	6
Frozen	1.4	3.1	3.4	4.1	193
Total	67.8	66.4	65.3	66.4	-2
Total vegetables	199.7	205.8	205.3	206.7	4
Melons	27.4	25.7	24.8	23.1	-16
Potatoes:					
Fresh 5/	113.4	101.6	102.2	98.9	-13
Canned	.3	.6	.7	.6	100
Frozen	.1	6.6	7.1	9.3	9200
Total	113.8	108.8	110.0	108.8	-4
Sweetpotatoes:					
Fresh 6/	12.5	6.3	5.6	6.4	-49
Canned 3/	.5	1.0	1.1	1.5	200
Total	13.0	7.3	6.7	7.9	-39
Total	353.9	347.6	347.3	346.5	-2

1/ Excludes home-garden production. Civilian consumption only.
2/ Preliminary.
3/ Excludes quantities used for soups and baby food.
4/ See Consumption of Food in the United States, 1909-52 for items included.
5/ Potatoes used fresh plus processed items other than canned and frozen (i.e., quantities dehydrated, used for chips and shoestrings in mixtures and flour).
6/ Includes processed sweetpotatoes other than canned.

Supplements for 1961 and 1962 to Consumption of Food in the United States, 1909-52, ERS, USDA, sup. for 1962 to Agr. Handbook 62, Oct. 1963.

70 percent of their total supplies directly at shipping points, nearly all by their own field buyers.

The regional chains--those with produce warehouse divisions in different cities--are not large enough to maintain field buying offices as extensive as the national chains, but many have field offices in major production areas. The regional chains buy about half of their supplies directly at shipping points. Of their direct purchases, about 45 percent are made through their own field buyers and another 45 percent from the central office by telephone. About 10 percent is bought through buying brokers at shipping points.

Local chains--those with only one warehouse--usually do not have their own field buying staff. They purchase less than 30 percent of their volume of produce at shipping point. Of these direct purchases, nearly two-thirds are made by telephone directly to the shipper and the remaining third through buying brokers at shipping points.

Few wholesaler-sponsored voluntary food chains handle fresh fruits and vegetables. Those that do, buy about a third of their produce directly from shipping point--almost three-fourths by telephone and the remainder through shipping-point buying brokers.

The retailer cooperatives--wholesale organizations owned by member retailers --buy about 13 percent of their volume directly from shipping point. About two-thirds of direct purchases are made though shipping-point buying brokers and one-third by telephone.

Retail food chains adopted direct buying of fruits and vegetables at retail to obtain the quality of product in adequate volume they needed at a particular time. When "specials" on fruits and vegetables are planned, a large chain generally does not want to rely on terminal markets whose supply consists mainly of smaller lots of nonuniform quality. Also, direct buying avoids terminal market brokerage fees and other selling costs. Handling costs in terminal markets often have been high because of inadequate facilities, traffic congestion and high cartage charges.

City wholesalers still play an important role in marketing fresh fruits and vegetables despite increased rise of direct buying. Large chains do some buying from city market dealers, and many smaller chains buy from city dealers all but a few fresh fruits and vegetables, such as potatoes, onions, and citrus fruits that are sold in large volume. The smallest chains, unaffiliated independent retailers, restaurants, and institutions generally buy all their fresh produce from city dealers.

Changes in wholesale markets.--The total volume of fresh fruits and vegetables handled by city wholesalers declined about 10 percent between the late 1930's and the late 1950's. This decline resulted from the growth in direct buying and an increase of only about 1 percent in the combined volume of domestic and imported fresh fruits and vegetables marketed. The decline in volume handled by city wholesalers may explain at least in part the reduction in the number of wholesale firms. According to the Red Book, the number of wholesalers of all types in 145 markets declined 19 percent between 1939 and 1958. The number of receivers, commission merchants, and receiver-jobbers declined 27 percent. Also, the number of jobbers declined 29 percent, brokers, 41 percent, and buying brokers, 8 percent. During the same period, the number of repackers and packagers listed increased from 15 to 205; truck jobbers increased 44 percent; and the number of importers and exporters remained unchanged. Some of these changes in numbers of firms by classes may have resulted from firms altering the nature of their operations and services in response to changing needs and demands of the wholesale markets.

Since 1939, 5,100 wholesalers in the 52 markets surveyed by the Economic Research Service have left the produce business. But, in that same period, 3,700 others entered the field. Of the

firms in business in 1958, 8 percent had been in business 50 years or more; a third for 30 years or more; and 19 percent were new within the last 16 years or less.

The number of auction markets also has declined in recent years. Auctions in Baltimore and Cincinnati discontinued operation within the last 6 years. Terminal auctions operated in 8 cities in 1962 but in 12 cities in 1935. Fruit auctions were the major distributors for citrus and West Coast deciduous fruits. In 1930, they handled 84 percent of the citrus fruit received in auction cities and nearly as high a percentage of western deciduous fruits. They were the mass distributors of these fruits at the wholesale level. They maintained this position fairly well during the 1930's.

Auction sales declined from a third of all citrus and 10 percent of all deciduous fruit fresh sales in 1937 to 15 percent of the citrus and 6 percent of the deciduous fruit sales in 1957.

The auctions are becoming specialty distributors rather than mass distributors. Sales of higher-valued fruits are holding up much better than those of lower-priced, large-quantity items. Chainstores and wholesalers prefer to buy their large volume produce items directly from shipping points. The auctions seem well suited to the sale of imported fruit -- most of it from Chile and Argentina -- and the New York City auction probably will retain a large share of the sales of these commodities. Other auctions are in Boston, Chicago, Cleveland, Detroit, Philadelphia, Pittsburgh and, St. Louis.

Wholesale markets for fresh fruits and vegetables gradually are being forced to move from old inefficient locations in the larger cities to areas on the peripheries where land is cheaper and more adequate facilities can be built. Traditional wholesale markets usually consisted of multistory buildings on either side of narrow streets. The buildings were inefficient for servicing orders and increased truck transport made the streets impassable during peak trading hours.

New markets built in many major cities consist of groups of 1-story buildings with rail docks on one side and wide truck-loading platforms on the other. These markets are food distribution centers that handle other food products in addition to fresh fruits and vegetables. The buildings are well adapted to the use of modern materials-handling equipment, such as fork-lift trucks and conveyor belts. Each wholesale company has ample refrigerated storage facilities for holding fruits and vegetables. In some warehouses, several cold rooms are available, each with different temperature settings, so that each fruit or vegetable may be stored at the proper temperature for optimum quality.

New, more convenient, and more efficient wholesale facilities have enabled some firms to become less specialized in the wholesale function. Firms now can handle a wider variety of fruits and vegetables and offer more services to customers. Many items that formerly were packaged at the retail or shipping-point levels are now prepackaged in the new wholesale facilities. The number of firms prepackaging produce -- especially tomatoes -- has increased sharply in recent years, while the number of regular produce wholesalers has declined.

Transportation.--Transportation costs account for a larger part of marketing costs for fresh fruits and vegetables than for other food product groups. This is true because: (1) Some areas best adapted to producing these crops are distant from many of the large population centers, and (2) the products are perishable and relatively bulky.

An outstanding development in transporting fresh produce in recent years has been the shift from rail to highway transport. Though the tonnage of fresh fruits and vegetables marketed by growers was 4 percent larger in 1961 than in 1947-49, rail shipments were 45 percent smaller than in the earlier period. Much

of the diversion from rail to motor-truck transport was in short-haul shipments. Thus, the decline in rail shipments from the Pacific Coast States to eastern markets has been almost negligible, and the decline in shipments from Florida to eastern markets was much greater than 45 percent.

The expanded use of trucks since World War II accompanied a decline in rail shipments and, to a much smaller extent, the demise of coastwise water transport from Florida to Atlantic Coast cities. During the 1930's between one-third and one-half of the marketings of Florida citrus fruit was transported by ships to New York and other East Coast cities. In 1935, 12,744 carload equivalents of oranges, out of a total of 22,702, were transported by ships. During World War II, citrus shipments were curtailed since ships were needed by the armed services. After the war, sharp increases in coastwise carrier rates were required to cover increased capital, labor, and other costs of ship operations. Higher rates caused a diversion of shipments from water to rail and highway transport. Only a few water shipments were made in 1946 and none since. Truck shipments of Florida citrus fruits and vegetables to northern and eastern markets grew rapidly, aided by back hauls of deciduous fruits to the booming population in Florida and other southeastern States and grain to the rapidly-growing broiler industry in Georgia.

Big improvements in highways and vehicles favored growth in truck traffic. Highways were widened, cities bypassed, and routes shortened. Diesel-powered tractors became common. Lighter-weight and stronger materials in trailers increased payloads and decreased operating costs. Many trucks were equipped with mechanical refrigeration units, providing lower temperatures and a better control than older methods of refrigeration. Truck terminal facilities also were improved. Truck shipments were particularly adapted to supplying markets too small to take rail car shipments. Trucks enabled these markets to receive produce directly from producing areas rather than through a nearby city wholesale market.

Railroads likewise improved their services. Adoption of diesel locomotives made possible faster schedules, longer and heavier trains, and lower costs. Centralized traffic control also speeded schedules. Waiting time in classification yards -- one of the principal reasons shipping generally is slower by rail than by truck -- was reduced. Refrigerated rail cars, like trucks, were greatly improved. Recently railroads offered shippers of fruits and vegetables rates that are lower per package if rail cars are loaded to heavier weights. The improved structure and refrigeration equipment of modern refrigerator cars made heavier loading feasible. Newly developed methods of loading, improved refrigeration, more precooling before shipment, and use of mold inhibitors reduce the risk of spoilage.

Railroads began piggy-back shipments of fresh fruits and vegetables from some areas in the 1950's. Shipping loaded trailers on flat-bed rail cars provided the flexible-type transportation shippers found so advantageous in truck transportation. Fruits and vegetables can be loaded in a trailer at a country packing house, transported to the rail head, and delivered at the city warehouse (which need not be on a railroad) of a food chain or wholesaler for unloading.

In 1962, 10,696 trailers loaded with fresh fruits and vegetables were shipped piggy-back, up from 2,421 in 1960. 8/ In the first 6 months of 1963, piggy-back shipments of these products totaled 8,077 trailers, suggesting the possibility of a 60 percent increase this year over 1962.

Marketing Processed Products

Changes in the processing industries.-- The 1961 output of industries producing

8/ Shipment data obtained from Agricultural Marketing Service, USDA.

processed fruits and vegetables was 64 percent higher than the 1947-49 average. 9/ Plants producing frozen fruits and vegetables increased output more than canning and preserving plants. The index of output of frozen fruits and vegetables (1947-49 = 100) was 416 in 1960, compared with an index of 130 for canned fruits and vegetables.

The number of plants drying and freezing fruits and vegetables was larger in 1958 (the latest year for which census data are available) than in 1947, but fewer plants were canning these products. Fewer plants in the canning industry does not necessarily indicate less total plant capacity. Many fruit and vegetable canning firms have built new plants and installed new equipment to modernize and enlarge existing facilities. Since a company generally builds a plant or installs equipment to accommodate an expected increase in output, new and modernized plants often are larger than plants they replace. In some instances, new equipment and processes were suitable only for relatively large plants.

Entry into the fruit and vegetable processing industry is relatively easy compared with entry into many other industries, and competition is keen. Large firms in the canning and freezing industries have a smaller share of total industry sales than in many other food manufacturing industries. The 4 largest fruit and vegetable canning companies made 29 percent of industry sales in 1958, about the same share as in 1947; the 20 largest companies made 55 percent of total sales, up from 46 percent in 1947. 10/ The 4 largest freezing companies accounted for 31 percent of total industry sales in 1958, compared with 39 percent in 1954 (the earliest year for which data are available). In the dehydrated fruits and vegetables industry, the 4 largest firms had 45 percent of the total sales in 1958 and 26 percent in 1947. Concentration in the dehydrating industry appears to have increased, probably due to the decline of sun-drying and the increased equipment needed for new, faster, methods of dehydrating.

The location of the fruit and vegetable canning industry, as indicated by census data on value added by manufacture in various regions, appears to have remained rather steady in the 1950's. Slight decreases in the percentage of total value added in the Middle and South Atlantic Regions were offset by increases in the East North Central and Western Regions. In the freezing industry, the percentage of the total value added by manufacture declined in the Middle Atlantic, West South Central, and Western Regions, but increased in New England (greatly expanded freezing of potatoes) and the South Atlantic Region.

Western States account for much of the output of processed deciduous fruits. Practically all of the dried fruit and 75 percent of the canned and other processed deciduous fruit are produced there. Florida leads in production of processed citrus fruits. The Western Region also leads in the volume of vegetables processed. Much of the increase in that region has been in frozen vegetables. The North Central Region produces a large share of the canned vegetables.

Output per man-hour in 1958 was 41 percent greater than in 1947-49 in plants processing fruits and vegetables. 11/ Improvements in plant and equipment accounted for much of this increase. New plants generally were designed to improve

9/ Waldorf, William H., Output of Factories Processing Farm Food Products in the United States, 1909-1958, U. S. Dept. Agr. Tech. Bull. 1223, Sept. 1960. Data for 1959-61 were furnished by the author.

10/ Concentration Ratios in American Industry, report prepared by the Bureau of the Census for the Subcommittee on Antitrust and Monopoly to the Committee on the Judiciary, United States Senate, (87th Cong., 2d Sess., 1957) table 2.

11/ Waldorf, William H., Output Per Man-Hour in Factory Processing of Farm Products, U. S. Dept. Agr., Tech. Bull. 1243, May 1961.

efficiency in materials handling and work flow. Use of fork-lift trucks and conveyor systems reduced the man-hours required to handle raw materials and finished products. Continuous cookers replaced batch methods in canneries. A continuous dehydrator now is used. It has a belt-trough dryer on which fruit is dried uniformly and cuts labor costs. These illustrate only a few of many improvements. Improvements in labor and management skills and economies of scale have also increased output per man hour.

Potatoes.--The rapid growth in potato processing is a significant recent development in the food industries. Approximately 54.5 million hundredweight of potatoes from the 1962 crop were processed into food products. This quantity compares with 40.1 million hundredweight from the 1959 crop. Potato volumes used for processed food items, such as chips and frozen, dehydrated and canned products have increased steadily in recent years.

Processors of potato chips and shoestring potatoes took about 44 percent of the potatoes processed for food from the 1962 crop. Potatoes used for making french fries totaled 15.9 million hundredweight, the same quantity as from the previous crop and 2.3 million hundredweight (19 percent) more than from the 1960 crop. Processors of flakes, granules, diced, and other forms of dehydrated products took 9.3 million hundredweight from the 1962 crop, 9 percent more than from 1961 crop but 8 percent less than from the 1960 crop. Idaho has had the fastest growth in potato processing and in 1960 provided about 60 percent of the supply of dehydrated and frozen potatoes. Other leading areas are Washington, Maine, and the Red River Valley in North Dakota and Minnesota.

The growing consumer acceptance of factory-processed potato products appears to have arrested or reversed the long-time (40 years or more) downward trend in the per capita potato consumption. Consumption rose from an annual average of 106.9 pounds per person in 1957-59 to 108.8 pounds in 1962. Most of the increase was in use of frozen and dehydrated products.

Wholesaling processed fruits and vegetables.--Retailers increased their use of direct buying of processed as well as fresh fruits and vegetables. Some retail chains contract with processors to have fruits and vegetables packed under the retailers' brands. According to the Census of Manufactures, nearly 80 percent of the dollar volume of manufacturers' sales of canned and dried fruits and vegetables was made to wholesalers in 1939, 15 percent to retailers, and 1 percent to industrial users. Exact data are not available from the Census for 1958, but available data do show that, by that year, sales to wholesalers made up a much smaller proportion that in 1939, and sales to retail outlets and to industrial and institutional buyers -- either directly or through manufacturers' sales branches -- had risen substantially.

Sales to wholesalers were 66 percent of manufacturers' sales of frozen fruits and vegetables in 1939. By 1958, these sales had dropped to nearly half of the total. Sales to retail stores were only 15 percent of manufacturers' sales in 1939 compared with about one-third in 1958.

The distribution of merchant wholesaler sales of canned and frozen fruits and vegetables shifted from industrial and wholesale outlets to retail outlets between 1948 and 1958 (table 11). Sales of canned fruits and vegetables to retailers rose from 45 percent to 69 percent of total merchant wholesaler sales during the 1948-1958 period. Sales of frozen fruits and vegetables rose from 54 to 60 percent. The proportion sold to export outlets declined sharply. These declines might be indicative only for the years for which data were available, however, rather than of trends during the period.

Table 11.--Distribution of merchant wholesaler sales, 1948 and 1958 1/

Sales outlet	Canned fruits and vegetables		Frozen fruits and vegetables	
	1948	1958	1948	1958
	Percent	Percent	Percent	Percent
Industrial and commercial uses	11.3	7.2	17.4	15.3
Retailers	45.5	68.7	54.4	60.0
Wholesale organizations	29.7	20.3	23.8	23.0
Household consumers	.6	.8	1.3	.5
Export	12.9	3.0	3.1	1.2

1/ Does not include sales of brokers and agents.

Census of Business, 1948, Vol. IV, 401 - 407 and 1958, Vol. II, 4 - 2 to 4 - 4.

The Outlook for Marketing Fruits and Vegetables

Impact of population changes.--The total volume of fruits and vegetables marketed will increase in the years ahead, mainly because of population growth. Continued movement of families from farm to nonfarm homes also will add to total demand for commercially produced fruits and vegetables, since many farm families produce part or all of the fruits and vegetables they consume. Changes in the geographical distribution of the population may affect the production and marketing of these products. Population is expected to expand greatly in or near some of the areas best adapted for fruit and vegetable production -- the Pacific Coast States and Florida. Increased demand for land for non-agricultural uses already has curtailed production in parts of these States. Competition for land and water will increase. Population growth in and near the producing areas will tend to reduce transportation costs for these products.

The effect of income on demand.--The expected rise in per capita disposable income may increase the demand for many fruit and vegetable products, depending on relative prices of all foods and the supply response. However, per capita consumption is likely to respond only slightly to increases in income over the next few years. Gains in income will affect consumption of some fruits and vegetables more than others. Generally the largest increases arising from income growth will be in the consumption of processed products.

These conclusions are based on the results of 2 independent calculations of consumption-income relations, one using time series data and the other household budget data. Daly, using time series data and a trend variable to allow for changes in taste, estimated that coeffecients of income elasticity for vegetable products ranged from -0.1 for white potatoes to 0.4 for frozen vegetables and fresh leafy, green and yellow vegetables, and tomatoes. 12/ Elasticities for fruits ranged from 0.0 for dried fruits to 0.8 for processed citrus products. For fresh citrus fruits, the elasticity was 0.6, and for fresh apples, 0.2. Waldorf, using data from the Household

12/ Daly, Rex F., A Profile of Agriculture Projected to 1968, unpublished notes and materials for discussion at the Great Plains and Western Outlook Conference, July 22, 1963.

Food Consumption Survey conducted by the USDA in 1955 found that income elasticities were higher for processed than for fresh fruits and vegetables and of the processed products elasticities were highest for frozen products. 13/

Thus, income elasticities indicate that the shift in consumption during the last decade from fresh to processed products will continue and that the largest increases will be in the consumption of frozen products. This shift, however, will also be affected by changes in prices of processed fruits and vegetables relative to those of the fresh products. Per capita consumption of all fruits and vegetables may not rise significantly from levels of the past decade.

Increased volume of processing.-- Several factors in addition to the growing population and rising income per capita are expected to increase the volume of fruits and vegetables processed. Among these factors are: (1) A burgeoning demand for convenience foods, (2) development of new and improved products, and (3) use of new technologies.

Increased employment of women outside the home and their desire to devote more time to activities outside the kitchen (coupled with rising incomes) have accounted for much of the increased use of convenience foods. These factors will continue to boost demand for these products.

The development of new products -- frozen orange juice concentrate, for example -- and improvements in the quality of products have contributed greatly to the increase in processing. Fruit and vegetable processing firms are spending large sums on developing new and improved products. One may expect that these efforts will result in more processing.

Several new methods of processing fruits and vegetables are now in experimental stages of development or have been used commercially only for processing small volumes of high-value products. These new methods may be much more widely used in the future. Dehydrofreezing, a promising new method of freezing, has been used commercially to process fruits and vegetables on a limited scale. As the name implies, much of the water is removed before a product is frozen, thus reducing its bulk and weight. Costs of packaging and shipping are smaller for these products than for conventionally frozen products, but dehydration adds to processing costs. A growing volume of fruits and vegetables may be processed by freeze-drying, a method by which moisture is largely removed from conventionally frozen products. The final product is a dried, not a frozen, product. It may be shipped and stored without refrigeration and is lightweight. Freeze-dried foods retain more of the flavor of the original product than do most foods dried by heat. Freeze-drying, however, is more expensive than other processing methods. At present, its greatest potential for fruit processing seems to be in freeze-drying berries and other fruits for use by bakeries and other food manufacturers. Vegetables now are freeze-dried for use in soups and other products, and the volume processed in this way may grow. The foam-mat and vacuum-puff methods of drying show promise for making instant mixes and for making dried granules and flakes that can be reconstituted. Asceptic canning, a new technique, produces higher quality canned fruits and vegetables than are now available. Research is continuing to improve various methods of processing.

Further growth in direct buying.-- Retail firms probably will increase their direct purchases from shipping point dealers. The number of retail food chains large enough to engage in direct buying is likely to increase because of mergers and the opening of new stores. Further, chains now doing some direct-buying may increase this buying. Direct buying is not expected to account for more than 60 percent of the total volume of fresh fruits and vegetables marketed in the

13/ Waldorf, William H., unpublished estimates.

foreseeable future. Three groups of customers depending heavily on city wholesalers, will probably keep the wholesalers market share from decreasing to less than 40 percent of total marketings. These groups are: (1) Restaurants, hotels, and institutional buyers, few of which are large enough to buy directly from shipping point dealers; (2) unaffiliated independent grocery stores; and (3) chainstores that buy specialty items, prepackaged items, and fill-in supplies from local wholesalers.